

U.S. Patent Application No. 09/945,340
Amendment dated November 13, 2006

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REMARKS

Reconsideration and continued examination of the above-identified application are respectfully requested.

Claims 5, 11-76, 78, and 79 are pending.

In the present Amendment, claim 5 has been amended to recite that the carbonaceous material is particles having a size of from about 1 micron to about 500 microns. Full support for this amendment can be found throughout the present application, including page 7, lines 16-20, of the present application. Accordingly, no questions of new matter should arise and entry of this Amendment is respectfully requested.

Rejection of claims 5, 16, 19, 21, 28, 31, 33, 39, 42, 44, 51 and 53 under 35 U.S.C. §102(b) over Stalling et al.

At page 2 of the final Office Action, the Examiner rejects claims 5, 16, 19, 21, 28, 31, 33, 39, 42, 44, 51, and 53 under 35 U.S.C. §102(b) over Stalling et al. (U.S. Patent No. 5,308,481) for the reasons of record. The Examiner provides additional comments in response to applicants' arguments made in the response dated December 19, 2005. At page 3 of the Office Action, the Examiner states that it appears that the applicants are arguing that none of the groups disclosed by Stalling et al. have the aromatic portion of the defined group attached to the carbonaceous material. Further, the Examiner asserts that the instant claims do not require direct attachment of a benzene or phenyl to the carbonaceous material. The Examiner alleges that Figure 10B of Stalling et al. does disclose an aromatic group, since the specification defines Ar as an aromatic radical such as an aryl or heteroaryl group. The Examiner therefore takes the position that the present claims are clearly encompassed and anticipated by the Stalling et al. patent. The

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Examiner then alleges that the core-shell particle attached to the fullerene, as disclosed by Stalling et al., would read on the carbonaceous material that has an attached polyethylene glycol derivative as claimed. For the following reasons, this rejection is respectfully traversed.

As shown in amended claim 5, the carbonaceous material is particles having a size of from about 1 micron to about 500 microns. The carbonaceous material is the stationary phase and organic groups are attached to the carbonaceous material. As described in the present application, the attached organic group affects the adsorbent capacity and selectivity of the carbonaceous material.

Unlike the claimed invention, Stalling et al. actually shows conventional resin and silica supports being used as the stationary phases, wherein very small diameter fullerenes are attached onto the resin and silica supports using reactive groups. It is noted that these fullerenes are extremely small in size. As shown in Figure 1A of Stalling et al., the size of the resin or silica support is shown as 1.9 microns, and the attachment of the fullerene would be significantly smaller than this resin or silica support as shown in Figure 1C. To further support this point, attached to this response is literature from the company that supplied the fullerenes in the examples of Stalling et al. As can be seen, Fullerene C₆₀ and Fullerene C₇₀ have a size of 7 - 9 Å diameter, which is significantly smaller than 1 micron. This would make sense because the fullerene would have to be significantly smaller than the size of the resin or silica support to which it is being ultimately attached to. Stalling et al. does not teach carbonaceous particles having a size of 1 to 500 microns. Accordingly, Stalling et al. is quite different from the claimed invention and this has been further emphasized with the amendments to claim 5 for the benefit of the Examiner.

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The applicants also respectfully submit that the Examiner has misinterpreted the Stalling et al. reference with respect to the claimed invention. The applicants' arguments made in the previous response are incorporated herein. In order to facilitate the Examiner's understanding of the claimed invention, portions of the applicants' prior arguments are reiterated herein. Additional arguments against the Examiner's new comments with respect to the rejection follow.

Independent claim 5 is directed to a separation device comprising a mobile phase and a stationary phase, wherein the stationary phase comprises carbonaceous material having attached at least one of the specifically defined organic groups set forth in the claim. As described for example at page 8, lines 22 - 28 and elsewhere in the present specification, the attached organic group affects the adsorbent capacity and selectivity of the carbonaceous material. Contrary to what is alleged by the Examiner, none of the attached organic groups set forth in claim 5 are described in Stalling et al. In particular, the abstract of Stalling et al., referred to by the Examiner, only states that the invention relates to fullerenes covalently bonded to a polymer particle or a siliceous support particle, and col. 4, lines 58 - 66 of Stalling et al. only describes reactive groups such as $-\text{CH}_2\text{X}$, $-\text{OH}$, $-\text{NH}_2$ and $-\text{COOH}$ being bonded onto the fullerene to facilitate the attachment of the fullerene to a polymer particle. Figure 10B of Stalling et al. shows a linkage between a fullerene and a polymer particle, but this linkage is not made by a group defined in claim 5. Contrary to what is alleged by the Examiner, an "aromatic- $(\text{C}_n\text{H}_{n+1})$ " group is not a group that is defined in claim 5, nor is such a group disclosed in Stalling et al. The Examiner seems to intend to refer to the " $-\text{Ar}-(\text{C}_n\text{H}_{2n+1})_x$ " group, which is included in claims 5 and 19 (and, by dependency, claims 31, 42, 51, and 53). Stalling et al. does not disclose any such group and, in particular, this group is not the linkage that is shown in Fig. 10B of Stalling et al. The formula "

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Ar-(C_nH_{2n+1})_x” requires that the aromatic portion of the defined group be attached to the carbonaceous material (since, as noted at page 19, lines 29 - 31, hyphens on one or more ends of a formula indicate the attachment to the carbon product or to another group). Moreover, according to the formula, none of the one or more aliphatic groups that are attached to the aromatic group connect to any other group, but rather, each ends in a methyl group. The linkage shown in Fig. 10B of Stalling et al., on the other hand is a C₈H₁₆ chain joined at one end to an oxygen atom bonded to a fullerene and joined at the other end to an NH group of a polystyrene-NH₂ polymer particle. Stalling et al. contains no teaching or suggestion of a carbonaceous material having an aromatic group attached to the carbonaceous material and one or more non-linking aliphatic groups (that is, groups that end in CH₃) attached to the aromatic group, as included in claim 5 and as required by claims 19, 31, 42, 51, and 53. Moreover, Stalling et al. contains no teaching or suggestion of a carbonaceous material with an attached phenyl or naphthyl group having ionic or ionizable groups, as included in claim 5 and as required by claims 28 and 39. Moreover, Stalling et al. contains no teaching or suggestion of a carbonaceous material with an attached polyethylene glycol or methoxy-terminated polyethylene glycol or derivatized resins thereof as included in claim 5 and as required by claims 21, 33, and 44. Contrary to what is alleged by the Examiner, this feature is not disclosed at col. 9, lines 10 - 21 of Stalling et al. This passage of Stalling et al. refers to glycol dimethacrylate, triethyleneglycol dimethacrylate and tetraethyleneglycol dimethacrylate as crosslinking agents that are combined with monomers in the formation of a core-shell polymer particle, which is one of the support particles mentioned in the reference. This particular passage of Stalling et al. has nothing to do with fullerenes, but rather relates to the formation of a specific type of particle to which a

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fullerene may be attached. Stalling et al. contains absolutely no description of a carbonaceous material that has an attached polyethylene glycol or methoxy-terminated polyethylene glycol or derivatized resins thereof.

Applicants would like to additionally point out the following to the Examiner. Column 5, lines 34-38 of Stalling et al. describes the polymers and the siliceous supports as support particles that are known for use as adsorbents. The applicants submit that these particles are not or do not contain the claimed organic groups. For example, Stalling et al. describes these polymers as polystyrenes, divinyl benzene, and other inorganic substrates (see column 6, lines 3-17 for example). Therefore, Stalling et al. does not teach or suggest a carbonaceous material having attached at least one organic group, wherein the organic group comprises an aromatic group that ends in the methyl group, as claimed. Moreover, Stalling et al.'s Figure 10B does not teach or suggest a carbonaceous material with an attached phenyl or naphthyl group having ionic or ionizable groups, as included in claim 5, and required by claims 28 and 39. Additionally, the cross-linking agents that the Examiner refers to at col. 9, lines 10-21 of Stalling et al., are not the same as the polyethylene glycol or methoxy-terminated polyethylene glycol or derivatized resins as included in claim 5 and as required by claims 21, 33, and 44. As indicated above, the particular passage of Stalling et al. that the Examiner refers to, has nothing to do with the fullerenes, but rather relates to the formation of a specific type of particle to which a fullerene may be attached. Therefore, Stalling et al. contains no teaching or suggestion of a carbonaceous material with an attached polyethylene glycol or methoxy-terminated polyethylene glycol or derivatized resins thereof.

Since Stalling et al. does not teach or suggest any of the above-described particular

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organic groups, Stalling et al. would not teach or suggest any separation device containing a second organic group in addition to one of these particular organic groups as required by claims 28, 31, 33, 39, 42, and 44. Therefore, this rejection should be withdrawn.

Rejection of claims 17, 29 and 40 under 35 U.S.C. §103(a) over Stalling et al. in view of Kusano et al.

At page 2 of the final Office Action, the Examiner still rejects claims 17, 29, and 40 under 35 U.S.C. §103(a) over Stalling et al. in view of Kusano et al. (EP 0 300 448) for the reasons of record. The Examiner provides additional comments in response to applicants' arguments made in the response dated December 19, 2005. At page 4 of the Office Action, the Examiner alleges that Stalling et al. teaches that different attachments of the organic compounds to the fullerenes affect the chromatographic separation of the obtained separation medium and are not there merely for the formation of a lattice structure (col. 4, line 50, to col. 5, line 28). The Examiner takes the position that the secondary references, which include Kusano et al., are cited to show the use of other organic compounds attached to the carbonaceous material. The Examiner again takes the position that it would have been obvious to modify Stalling et al. with the teachings of Kusano et al. on the alleged grounds that Kusano et al. teaches other organic groups attached to a carbonaceous material. For the following reasons, this rejection is respectfully traversed.

As discussed above, Stalling et al. attaches a very small diameter fullerene onto a conventional resin or silica support. This is clearly different from the claimed invention, as described above in the earlier rejection, and these differences and comments apply equally here and are incorporated in their entirety by reference herein.

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The applicants also respectfully submit that the Examiner has misinterpreted the Stalling et al. reference with respect to the claimed invention as indicated above. Applicants' arguments above and in the previous response are incorporated herein. In order to facilitate the Examiner's understanding of the both the Stalling et al. and the Kusano et al. references, portions of applicants' prior arguments are reiterated herein. Additional arguments in response to the Examiner's additional comments follow.

Stalling et al. does not teach or suggest any modification of fullerenes with organic groups that affect the selectivity of a chromatographic material and there is no indication that it would even be possible to make a stable modification of this type to a fullerene. Kusano et al. does not overcome the deficiencies of Stalling et al. Kusano et al. describes the use of a coating of an optically active amino acid derivative on a substrate to provide a separation medium for separating racemic mixtures. There is no teaching or suggestion in Stalling et al. or Kusano et al., either singly or combined, that the amino acid derivatives of Kusano et al. would be capable of performing the function of facilitating the attachment of fullerenes to polymer particles to form a lattice structure, or even that the amino acid derivatives of Kusano et al. could be attached to fullerenes at all. Kusano et al. does not teach any attachment of its amino acid derivatives to anything, but rather only describes coating the amino acid derivatives onto a substrate.

Also, if Stalling et al. was somehow combinable with Kusano et al., one skilled in the art would remove the fullerene and attach an amino acid onto the conventional resin or silica substrate of Stalling et al. This would clearly be different from the claimed invention since the claimed invention is using the carbonaceous material as the "substrate" to attach organic groups onto. There is no teaching or suggestion in Stalling et al. or Kusano et al., either singly or

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combined, that the amino acid derivatives of Kusano et al. would be capable of performing the function of facilitating the attachment of fullerenes to polymer particles to form a lattice structure, or even that the amino acid derivatives of Kusano et al. could be attached to fullerenes at all. Kusano et al. does not teach any attachment of its amino acid derivatives to anything, but rather only describes coating the amino acid derivatives onto a substrate. Accordingly, Stalling et al. and Kusano et al., either singly or combined, do not teach or suggest a separation device comprising a mobile phase and a stationary phase, wherein the stationary phase comprises carbonaceous material having attached at least one amino acid or derivatized amino acid, cyclodextrin, immobilized protein, polypeptides, or combinations thereof, as required by claim 17.

Regarding the Examiner's reference to col. 4, line 50, to col. 5, line 28, of Stalling et al., the applicants disagree with the Examiner's assertion that Stalling et al. teaches that different attachments of the organic compounds to the fullerenes affect the chromatographic separation of the obtained separation medium and are not there merely for the formation of a lattice structure. It appears that the Examiner is reciting this particular passage to Stalling et al. in response to the applicants' previous arguments regarding the deficiencies of Stalling et al. However, this particular passage only indicates that certain reactive groups can be used to link the fullerenes to the polymer or silica support. At col. 4, lines 64-66, Stalling et al. indicates that the reactive groups are used to form a lattice structure. At col. 5, lines 3-8, Stalling et al. indicates only that chromatography affinity is affected by the type of polymer particle, such as a co-polymer resin particle. As discussed above, these polymer particles that Stalling et al. refers to, are inorganic particles. No where does Stalling et al. teach or suggest that different attachments of organic

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compounds to the fullerenes affect the chromatographic separation of the obtained separation medium. Kusano et al. does not cure the deficiencies of Stalling et al., as discussed above.

Accordingly, Stalling et al. and Kusano et al., either singly or combined, do not teach or suggest a separation device comprising a mobile phase and a stationary phase, wherein the stationary phase comprises carbonaceous material having attached at least an amino acid or derivatized amino acid, cyclodextrin, immobilized protein, polypeptides, or combinations thereof, as required by claims 17, 29, and 40. Therefore, this rejection should be withdrawn.

Rejection of claims 18, 20, 22 - 27, 30, 32, 34 - 38, 41, 43, 45 - 50, 52, 54 - 76 and 78 - 79 under 35 U.S.C. §103(a) over Stalling et al. in view of Boes et al.

At page 2 of the Office Action, the Examiner rejects claims 18, 20, 22 - 27, 30, 32, 34 - 38, 41, 43, 45 - 50, 52, 54 - 76 and 78 - 79 under 35 U.S.C. §103(a) over Stalling et al. in view of Boes et al. (U.S. Patent No. 5,807,494) for the reasons of record. The Examiner provides additional comments in response to applicants' arguments made in the response dated December 19, 2005. At page 4 of the Office Action, the Examiner responds to applicants' previous arguments. Particularly, the Examiner's comments on the combination of Stalling et al. with Boes et al., are the same as with the combination of Stalling et al. and Kusano et al., as indicated above. For the following reasons, this rejection is respectfully traversed.

The deficiencies of Stalling et al. are indicated above. As discussed above, Stalling et al. only describes reactive groups as being bonded onto fullerene to facilitate the attachment of the fullerene to an inorganic polymer or siliceous particle or the attachment of fullerenes to each other. Stalling et al. does not teach or suggest carbonaceous particles having a size of about 1 micron to 500 microns. The applicants' arguments above and in the previous response are

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incorporated herein. In order to facilitate the Examiner's understanding of the deficiencies of both the Stalling et al. reference and the Boes et al. reference, portions of the arguments made in the previous response are reiterated below. Additional arguments in response to the Examiner's additional comments follow.

Stalling et al. only describes groups such as $-\text{CH}_2\text{X}$, $-\text{OH}$, $-\text{NH}_2$ and $-\text{COOH}$ that are capable of facilitating the formation of a lattice structure. Boes et al., on the other hand, describes carbon black products that have attached organic groups that provide the advantage of increased water dispersibility (see, for example, col. 5, lines 23 - 37 of Boes et al.). Clearly, this objective of providing increased water dispersibility is directly at odds to the objective in Stalling et al. of joining particles together into a lattice. There is no teaching or suggestion in Boes et al. of using organic groups to attach carbon black particles to anything else. Therefore, a person skilled in the art would not be motivated to modify Stalling et al. with the teachings of Boes et al. Moreover, since Stalling et al. does not teach or suggest any other use for reactive groups attached to the fullerenes except for providing the fixation of fullerenes and polymer or siliceous particles and since Boes et al. contains no disclosure relevant to chromatography at all, the motivation described in the present application of affecting the adsorption properties and the selectivity of a chromatographic material by attaching organic groups is not found in either reference, taken singly or combined.

With respect to the Examiner's additional comments regarding the combination of Stalling et al. and Boes et al. on page 4 of the Office Action, since these comments apply both to the Boes et al. and the Kusano et al. references, applicants' arguments with respect to the combination of Stalling et al. with Kusano et al. indicated above, apply equally here. Those

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arguments are incorporated herein. Boes et al. does not cure the deficiencies of Stalling et al., as indicated above.

One skilled in the art would have no reason to look to Boes et al. The carbon materials are different and the uses are different.

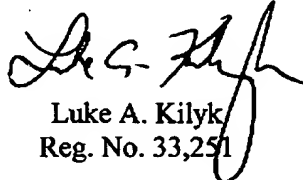
Accordingly, Stalling et al. and Boes et al., either singly or combined, do not teach or suggest a separation device comprising a mobile phase and a stationary phase, wherein the stationary phase comprises carbonaceous material having attached thereto the specific groups required by claims 18, 20, 22 - 27, 30, 32, 34 - 38, 41, 43, 45 - 50, 52, 54 - 76, and 78 - 79. Therefore, this rejection should be withdrawn.

CONCLUSION

In view of the foregoing remarks, Applicants respectfully request the reconsideration of this application and the timely allowance of the pending claims.

If there are any other fees due in connection with the filing of this response, please charge the fees to Deposit Account No. 03-0060. If a fee is required for an extension of time under 37 C.F.R. § 1.136 not accounted for above, such extension is requested and should also be charged to said Deposit Account.

Respectfully submitted,


Luke A. Kilyk
Reg. No. 33,251

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Atty. Docket No. 96074CIP2 (3600-011-03)

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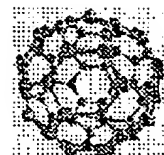
Tel.: (540) 428-1701

Fax: (540) 428-1720

Attachment: Literature from MER Corporation regarding MER Fullerene Products
(2 pages)



MER Fullerene Products



Item: Fullerene Soot

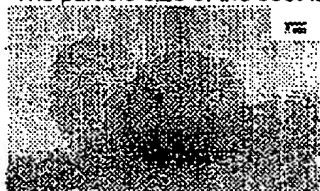
Catalog# MRST

Description: As-produced carbon soot prepared by the Kraetschmer-Huffman arc process. MER fullerene soot is guaranteed to yield over 7 wt% fullerenes when extracted with toluene. Typical composition of the extract is 75% C₆₀, 22% C₇₀, 3% higher-order fullerenes. The particle size of the soot is 0.02 to 10 microns. Powder density is about 0.05 grams/cc.

Prices for As-produced Fullerene Soot, Catalog# MRST.

Up to 100 grams \$3.00 per gram

Over 100 grams \$2.00 per gram



Item: Refined Mixed Fullerenes

Catalog# MRMF

Description: Fullerene extracted from arc-produced carbon soot. The fullerene mixture (also known as "fullerite") is a dark-brown amorphous powder that is soluble in toluene, benzene, carbon disulfide and other fullerene-friendly solvents. Fullerene composition is approximately 75% C₆₀, 22% C₇₀ and 3% higher-order fullerenes (C₇₆, C₇₈, C₈₄ and others). Powder density is about 0.8 g/cc.

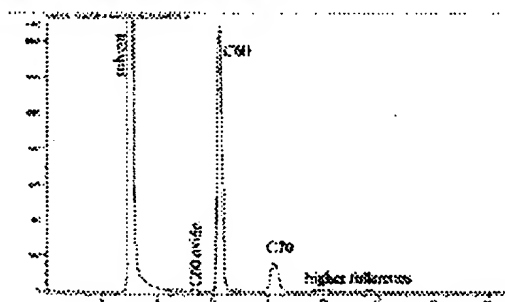
Prices

1-10 grams \$20.00 per gram

11 to 100 grams \$18.00 per gram

MRMF

Over 100 grams \$15.00 per gram



Typical HPLC Chromatogram of

Item: Fullerene C₆₀, 99+%

Catalog# MR6LP

Description: Over 99% pure C₆₀ produced by chromatography. The product is a dark brown powder with powder density of about 0.8 g/cc. Impurities include C₇₀ and C₆₀ oxides. The material may also contain up to 0.2% adsorbed solvent.

Prices

1-10 grams \$40.00 per gram

11-50 grams \$30.00 per gram

51-100 grams \$25.00 per gram

over 100 grams \$20.00 per gram

7 Å diameter



C₆₀

Item: Fullerene C₆₀, 99.9%

Catalog# MR6HP

Description: 99.9% or higher C₆₀ produced by chromatography and sublimed to remove traces of solvent and other contaminants. The product is a black crystalline powder with powder density of about 0.8 g/cc. Impurities are traces of C₇₀ and C₆₀ oxide.

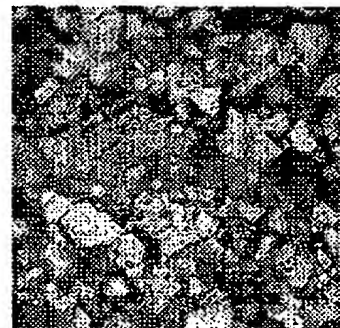
Prices

1-5 grams \$75.00 per gram

6-25 grams \$65.00 per gram

26-100 grams \$60.00 per gram

over 100 grams \$50.00 per gram



Optical Micrograph of MR6HP (100X)



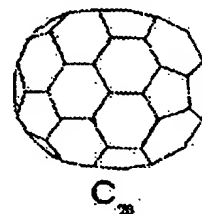
MER Fullerene Products

Item: 95+% C₇₀

Catalog# MR7LP

Description: C₇₀ produced in the arc, then purified to over 95% by chromatography. The material is a dark brown powder with powder density of about 0.8 g/cc. Impurities include C₆₀, higher order fullerenes and fullerene oxides. The product may contain up to 0.2% absorbed solvent.

9 Å diameter



Prices

1 gram	\$280
2-5 grams	\$270.00 per gram
6-25 grams	\$250.00 per gram
over 25 grams	ask

Item: 99+% C₇₀

Catalog# MR7HP

Description: 99% or higher purity C₇₀ produced in the arc, purified by chromatography, then sublimed to remove traces of solvent and other contaminants. The product is a black crystalline powder with powder density of about 0.8 g/cc. Impurities are traces of higher fullerenes and C₇₀ oxide.

Prices:

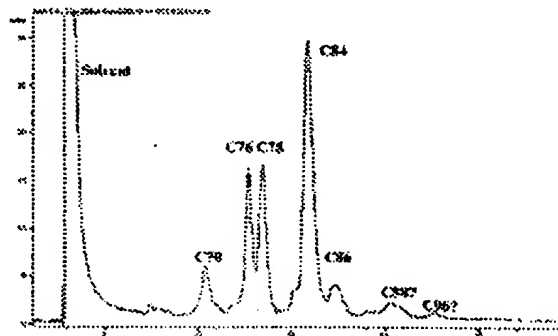
1 gram	\$400.00
2-5 grams	\$350.00 per gram
6-25 grams	\$325.00 per gram
over 25 grams	ask

Item: Higher-Order Fullerene Mixture

Catalog# MRHF

Description: Mixture of higher-order fullerenes produced by chromatography. Typical composition is around 20% C₇₆, 20% C₇₈, 40% C₈₄, with other higher-order fullerenes. A HPLC chromatogram is supplied with the material to indicate approximate distribution of fullerenes. Limited quantities are available.

Price: \$3.00 per mg



Typical HPLC Chromatogram of MRHF

Please fax purchase orders to MER Corporation Nanotubes at ++(520) 574-1983.

Payment in US\$ is due 30 days after receipt of the invoice. Payment accepted by check, money order, EFT or major credit card. Call or email for payment instructions.

Please email, call or write if you need a formal quotation, delivery estimate or if you have questions.

Timothy Lowe, Ph.D.
Materials and Electrochemical Research (MER) Corporation
7960 South Kolb Road
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Tel. (520) 574-1980 Ext. 128
Fax (520) 574-1983
email fullerenes@merc corp.com
website: www.mercorp.com